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Specification

Nonwoven Fabric for Loop Material of Hook-and-Loop Fastener and Manufacturing Process Thereof

Technical Field

The present invention relates to a simple and easy nonwoven fabric for loop material of hook-and-loop fastener used in disposable goods such as disposable diapers, operating gowns, etc.

Background Art

Hitherto, a hook-and-loop fastener is composed of a loop material having loop-shaped or arch-shaped engaged members and a hook material having mushroom-shaped or hook-shaped protrusions for engaging with the mentioned engaged members of the loop material. Such hook-and-loop fastener is employed in varieties of uses such as clothing, daily necessaries, interior materials, and industrial materials.

Recently, hook-and loop fasteners of necessary and sufficient characteristics as fasteners have been increasingly employed for disposable goods because of their simple and easy way of use. It is sufficient for the hook-and loop fasteners used in disposable goods to have durability and peeling strength enough for only joining several times. In particular, as for the loop material of hook-and-loop fastener, it is a recent trend that a fabric forming a main body of an operating gown, a diaper cover, a diaper, or the like is used to serve as the loop material of hook-and loop

fastener as it is. In other words, a loop material serving not only as a loop material of hook-and-loop fastener but also as fabric has been increasingly adopted. The following loop materials of hook-and loop fastener have been heretofore proposed as such a loop material. That is, (ⅰ) a filamentous nonwoven fabric having wrinkle portions is employed as the loop material of hook-and-loop fastener in which the wrinkle portions serve as engaged members (The Japanese Patent Publication (unexamined) No. 6-33359), (ⅱ) a nonwoven fabric composed of a large number of loops on one side which are formed by needle punching a fibrouse web and of fixed filaments or fibers on the other side which are fixed together with an adhesive material is employed as the loop material of hook-and-loop fastener, and the loops serve as engaged members (The Japanese Patent Publication (unexamined) No. 7-171011), and (ⅲ) a nonwoven fabric composed of a large number of loops on one side which are formed by needle punching a fiberous web and of fixed filaments or fibers on the other side which are fixed together by heat-bonding is employed as the loop material of hook-and-loop fastener, and the loops serve as engaged members (The Japanese Patent Publication (unexamined) No. 9-317).

However, in the case of (ⅰ), the loop material with the wrinkle portions serving as the engaged members does not perform sufficient peeling strength when it is engaged with the hook material. On the other hand, in the cases of (ⅱ) and (ⅲ), it is certain that the loops serve as the engaged members and the loop material has sufficient peeling strength when the loop material is joined to the hook material. The

filaments or fibers on the non-loop side are fixed together with an adhesive material or fixed by heat-bonding, and therefore the loop material of hook-and-loop fastener keeps its dimensional stability even after the loop material is repeatedly used several times. However, when such a loop material serves as a fabric, the loop material often directly touches the skin, and the mentioned fixation to the non-loop side gives rise to following problems. That is, there is a possibility of making the loop material stiff and hard, making the loop material disagreeable to the touch, and harming the skin. Due to the mentioned fixation, the filaments or fibers become tightly close to each other and air permeability is lowered, which eventually brings about any skin trouble.

Accordingly, it is an object of the present invention to provide a nonwoven fabric for loop material of hook-and-loop fastener in which the loop material has sufficient dimensional stability and peeling strength when the loop material is used for disposable goods, and the loop material is soft and has good air permeability even when the loop material is used not only as a loop material but also as a fabric.

Best Mode for Carrying Out the Invention

The present invention basically accomplishes the foregoing object as a result of successfully combining a nonwoven fabric base in which heat-bonded portions formed by heat-bonding filaments composing the nonwoven fabric together are dispersed and a filamentous web in which filaments are not fixed to each other.

More specifically, the invention basically relates to a nonwoven fabric for loop material of hook-and-loop fastener and a manufacturing process thereof, characterized in that the nonwoven fabric for loop material of hook-and-loop fastener is formed by laminating and joining together a nonwoven fabric base composed of thermoplastic filaments A, in which heat-bonded portions formed by heat-bonding the thermoplastic filaments A together by softening or melting the thermoplastic filaments A are dispersed, and a filamentous web composed of thermoplastic filaments B, the nonwoven fabric for loop material of hook-and-loop fastener has a loop side in which some parts of the thermoplastic filaments B passes through the nonwoven fabric base and form loops on a surface of the nonwoven fabric base, the thermoplastic filaments A and the thermoplastic filaments B are entangled with each other, and the thermoplastic filaments B are not substantially fixed to each other on a non-loop side opposite to the loop side. Other modifications will become apparent in the following description.

First, described below is a nonwoven fabric base used in the invention. This nonwoven fabric base is composed of thermoplastic filaments A. Polyester filaments, polyamide filaments, polyolefin filaments, or the like are used as the thermoplastic filaments A. It is preferred to use a sheath-core type conjugate filament composed of a high melting point core component and a low melting point sheath component. In this case, it is preferred to use polyethylene terephthalate as the core component and use polyester, polypropylene, polyethylene, or the like whose melting point

is lower than that of the core component as the sheath component.

The thermoplastic filaments A are heat-bonded together by softening or melting themselves. In the case that each of the thermoplastic filaments A is the sheath-core type conjugate filament, they are heat-bonded by softening or melting each sheath component. In the case that each of the thermoplastic filaments A is single component type filament, they are heat-bonded by softening or melting the whole of the part of each filament. The former is more preferable because the core component maintains the filament configuration even after the heat bonding and the nonwoven fabric base itself maintains its high tensile strength. The heat-bonded portions are dispersed in the nonwoven fabric base in such a manner as shown in Fig. 1, for example. In Fig. 1, reference numeral 1 is the nonwoven fabric base, and numeral 2 is the heat-bonded portion. The thermoplastic filaments A are not heat-bonded outside the heat-bonded portions, and the thermoplastic filaments A can move freely to a certain extent among the heat-bonded portions where the filaments A are constrained.

Size of each individual heat-bonded portion is preferably in the range of 0.04 to 2mm^2, and total size rate of the heat-bonded portions is preferably in the range of 2 to 50% of the surface size of the nonwoven fabric base. If size of each heat-bonded portion is smaller than 0.04mm^2 and the gross size rate is less than 2%, the technical advantage of having the heat-bonded portions is not sufficiently performed, and consequently, the loops get out easily and fluffing takes place easily after only several

times of joining with a hook material. On the other hand, if size of each heat-bonded portion is larger than $2mm^2$ and the gross size rate is more than 50%, strength of the nonwoven fabric base is unnecessarily increased, and consequently, the obtained loop material may be sufficient in dimensional stability, but the loop material tends to be decreased in softness.

Weight of nonwoven fabric base is preferably in the range of 10 to $130g/m^2$. If weight of the nonwoven fabric base is less than $10g/m^2$, amount of filaments per area tends to be decreased, and the technical advantage of constraining the loops having passed through the nonwoven fabric base tends to be reduced. Moreover, the loop material of hook-and-loop fastener tends to be decreased in dimensional stability. On the other hand, if weight of the nonwoven fabric base is more than $130g/m^2$, weight of the whole nonwoven fabric for loop material of hook-and-loop fastener is unavoidably increased, and the nonwoven fabric tends to be stiff and hard, and to increase in cost.

The nonwoven fabric base is preferably not more than 400μm in thickness. If the nonwoven fabric base is more than 400μm in thickness, the loops passing through the nonwoven fabric base and formed on the surface of the nonwoven fabric base stand relatively low in height. Thus, the nonwoven fabric tends to have less strength of joining with the hook material.

Any fineness of each filaments can be used as the thermoplastic filaments A composing the nonwoven fabric base, but it is preferred to use each filament of 1 to 15 dtex in general. It is more preferred to use each filament of

fineness smaller than the fineness of the thermoplastic filaments B composing the filamentous web. This makes it easier to obtain a dense nonwoven fabric base, and the loops passing through the nonwoven fabric base are held more effectively.

On the other hand, merely accumulating the thermoplastic filaments B forms the filamentous web, and the filamentous web does not have any heat-bonded portion like those in the nonwoven fabric base. In the same manner as those in the thermoplastic filaments A, polyester filaments, polyamide filaments, polyolefin filaments or the like are used as the thermoplastic filaments B. It is preferred to use a sheath-core type conjugate filament composed of a high melting point core component and a low melting point sheath component. In this case, it is preferred to use polyethylene terephthalate as the core component and use low-melting-point polyester, polypropylene, polyethylene, or the like as the sheath component. It is preferred to use filaments soluble with the thermoplastic filaments A, for example, filaments of the similar type, as the thermoplastic filaments B. This is because if the thermoplastic filaments B are soluble with the thermoplastic filaments A, they do not become slippery with each other, and the thermoplastic filaments B passing through the nonwoven fabric base are effectively constrained by the thermoplastic filaments A in the nonwoven fabric base, and consequently, it is possible to prevent the loops from getting out.

Each fineness of the thermoplastic filaments B is preferably in the range of 1 to 15 dtex , and more preferably

in the range of 5 to 10 dtex. If the each fineness is less than 5 dtex, the thermoplastic filaments B forming the loops to be engaged with the hook material is excessively weak, and consequently, the thermoplastic filaments B forming the loops are easily cut at the time of peeling the hook material from the loop material after joining the hook material with the loop material, and durability and peeling strength of the loop material tends to be decreased when the loop material is repeatedly used. When forming the loops by needle punching, the thermoplastic filaments B easily break due to friction generated by a punching needle passing through the thermoplastic filaments B, and this makes it difficult to form the loops having a sufficient peeling strength serving as the loop material. On the other hand, if each fineness is more than 15 dtex, it is certain that the thermoplastic filaments B have a sufficient strength, but stiffness of the loops is increased. This brings about a phenomenon called joining spots in which the loop material is not easily joined with the hook material and may not have any uniform peeling strength.

Weight of the filamentous web is preferably not less than $10g/m^2$, and more preferably not less than $20g/m^2$. If the filamentous web is less than $10g/m^2$, number of the loops engaged with the hook member is relatively decreased. Upper limit of the weight of the filamentous web can be freely selected, but it is preferred to select a filamentous web of about $100g/m^2$ in view of cost and softness.

Some parts of the thermoplastic filaments B in the filamentous web pass through the nonwoven fabric base and forms the loops on the surface of the nonwoven fabric base

as schematically shown in Fig. 2. In other words, the thermoplastic filaments B in the filamentous web 3 pass through the nonwoven fabric base 1 and form the loops 4 on the surface of the nonwoven fabric base 1(note that the loops 4 are exaggeratedly illustrated larger than the actual loops). More parts of the thermoplastic filaments B pass relatively from outside of the heat-bonded portions 2 through the nonwoven fabric base 1, and the thermoplastic filaments B hardly pass through the heat-bonded portions 2. This is because the thermoplastic filaments A in the nonwoven fabric base 1 can move freely to a certain extent in the areas other than the heat-bonded portions 2. Some parts of the thermoplastic filaments B forms the loops, and the rest of them are entangled with the thermoplastic filaments A in the nonwoven fabric base. This entanglement with the thermoplastic filaments A also takes place in the areas other than the heat-bonded portions 2 so that the thermoplastic filaments A may move freely to a certain extent. As a result of the entanglement of the thermoplastic filaments B with the thermoplastic filaments A, the nonwoven fabric base 1 and the filamentous web 3 are joined together more tightly. In the invention, the side where the loops 4 are formed is called the loop side, and the opposite side of the loop side, i.e., the filamentous web side, is called the non-loop side, where the loops are not formed.

The non-loop side is composed of the thermoplastic filaments B forming the filamentous web, and the thermoplastic filaments B are not substantially fixed to each other on this non-loop side. In other words, the thermoplastic filaments B are not fixed together with any

adhesive agent nor fixed to each other by softening or melting the thermoplastic filaments B themselves. It is not preferred to fix the thermoplastic filaments B to each other on the non-loop side because this makes the loop material of hook-and-loop fastener stiff and hard and deteriorates in air permeability.

In the nonwoven fabric for loop material of hook-and-loop fastener according to the invention, the nonwoven fabric base, in which the heat-bonded portions formed by heat-bonding the thermoplastic filaments A together are dispersed, is used, and some parts of the thermoplastic filaments B in the filamentous web pass through the nonwoven fabric base mainly from the areas other than the heat-bonded portions, thereby forming the loops. Roots of these loops are held between the thermoplastic filaments A in the nonwoven fabric base, and these thermoplastic filaments A are secured at least in the heat-bonded portions. Therefore, the loops are secured to a certain extent, and are quite sufficient to serve as the nonwoven fabric for loop material of hook-and-loop fastener used in disposable goods. In the nonwoven fabric for loop material of hook-and-loop fastener according to the invention, the nonwoven fabric base has the heat-bonded portions, and therefore the tensile strength is higher than that of any base without heat-bonded portions. As a result, it is not necessary to apply any adhesive agent to the non-loop side or heat-bond the filaments together for the purpose of improving the tensile strength. Consequently, the nonwoven fabric does not bring any stiff and hard touch, and air permeability thereof is good. It is therefore desirable to

use this nonwoven fabric as a nonwoven fabric serving not only as fabric but also as the loop material of hook-and-loop fastener.

In the invention, it is preferred to provide a thermally-press-joined areas (including continouse area) where the nonwoven fabric base and the filamentous web are heat-pressed for the purpose of further securing the loops and increasing the strength in the lamination and integration between the nonwoven fabric base and the filamentous web. The thermally-press-joined areas is obtained by pressing and heating the nonwoven fabric base and the filamentous web from the loop side and the non-loop side, softening or melting the thermoplastic filaments A and the thermoplastic filaments B, and then hardening them. The loops change their configuration by the softening or melting in the thermally-press-joined areas, and therefore it is not allowed to form the thermally-press-joined areas on the whole nonwoven fabric, and it is essential to leave areas not thermally-press-joined. Fig. 3 is a schematic side view of the nonwoven fabric for loop material of hook-and-loop fastener provided with the thermally-press-joined area. Numeral 5 indicates the thermally-press-joined area, and numeral 6 is the area not thermally-press-joined. The loops 4 do not exist in the thermally-press-joined area 5, but the loops 4 are formed in the area 6 not thermally-press-joined. Likewise in Fig. 2, the loops 4 are illustrated larger than the actual loops.

It is preferred that each area not thermally-press-joined is surrounded by the thermally-press-joined areas (including continuous ares)

and the nonwoven fabric has plural areas not thermally-press-joined. This is because the loops in each area not thermally-press-joined do not easily get out in the case that each area not thermally-press-joined is surrounded with the thermally-press-joined areas. This is also because even if the loops get out and fluff is raised, thereby the thermoplastic filaments B being disengaged, the thermally-press-joined areas prevent the thermoplastic filaments B from getting out. Furthermore, it is preferred to provide not only one but plural areas not thermally-press-joined that are divided into small partitions in order to increase the mentioned advantage all the more.

It is preferred that each size of not thermally-press-joined areas is larger than $5mm^2$, and more preferably in the range of about 5 to $350mm^2$. If each size of not thermally-press-joined is less than $5mm^2$, each loop side is too small to achieve sufficient engagement with the hook material. On the other hand, if each size of not thermally-press-joined areas is more than $350mm^2$, the loops tend to get out easily. It is preferred that the gross size of not thermally-press-joined areas is in the range of 40 to 90% of the whole surface size. If the gross size occupied by the areas not thermally-press-joined is less than 40%, the areas of the loop side are small, and this decreases the portion useful for the engagement with the hook material and any sufficient engagement tends to be difficult. On the other hand, if the gross size occupied by the areas not thermally-press-joined is more than 90%, the thermally-press-joined areas are relatively small, and the

thermoplastic filaments B are not sufficiently secured, thereby the loops tend to get out easily.

The configuration of the thermally-press-joined areas and the areas not thermally-press-joined are not specifically limited, but several examples are shown in Figs. 4 to 7. Fig. 4 shows an example in which the thermally-press-joined areas are honeycomb-shaped continuous area. Fig. 5 shows an example in which the thermally-press-joined areas are lattice-shaped continuous area. Fig. 6 shows an example in which the thermally-press-joined areas are texture-shaped with vertical lines and horizontal lines arranged alternately. Fig. 7 shows an example in which the quadrilateral thermally-press-joined areas are arranged zigzag. Figs. 4 and 5 show the examples in which plural areas not thermally-press-joined are surrounded by the continuous thermally-press-joined area, and Fig. 6 shows an example in which the continuous area not thermally-press-joined is not surrounded by the thermally-press-joined areas. Fig. 7 is an example in which each of the thermally-press-joined areas surrounds the each area not thermally-press-joined, and the thermally-press-joined areas are not continuous in this example.

In the nonwoven fabric for loop material of hook-and-loop fastener according to the invention, it is also preferred that the whole nonwoven fabric is impregnated with any binder resin for the purpose of improving the dimensional stability and preventing the loops from getting out. In other words, it is preferred that the whole nonwoven fabric is impregnated with a binder resin to such an extent

that the nonwoven fabric for loop material is not hard to the touch and the air permeability of the nonwoven fabric for loop material is not negatively affected. Therefore, the binder resin is not selectively applied to the non-loop side but is applied to the whole nonwoven fabric.

As for the binder resin, it is possible to use any generally known synthetic elastic resin such as copolymer prepared by combining at least two kinds of monomers such as methyl acrylate, ethyl acrylate, butyl acrylate, methyl methacrylate, ethyl methacrylate, butyl methacrylate, acrylo-nitrile, and styrene and copolymerizing them at a desired mole ratio or a cross linked binder resin in which the copolymer is cross linked by a cross linking agent. However, there is a possibility that the nonwoven fabric for loop material is used in disposable goods that directly touch the skin such as diapers, and therefore it is necessary to choose the resin depending on the way of use.

It is preferred that amount of applying the binder resin is in the range of 1 to 15% by weight with respect to the mass of the nonwoven fabric for loop material, and more preferably in the range of 1 to 10% by weight. The binder resin is used for the purpose of improving the dimensional stability of the nonwoven fabric for loop material and preventing the loops from getting out, and accordingly this purpose is hardly attained if the amount of applying the binder resin is less than 1% by weight. On the other hand, if the amount of applying the binder resin is more than 15% by weight, the nonwoven fabric for loop material becomes stiff and hard, and the air permeability is lowered. Such a nonwoven fabric is not desirable for loop material.

It is preferred that weight of the nonwoven fabric for loop material is in the range of 20 to 150g/m^2. If weight of the nonwoven fabric for loop material is less than 20g/m^2, it is difficult to obtain any sufficient strength used as fabric, and the nonwoven fabric tends to easily deform when the nonwoven fabric is repeatedly joined with the hook material. On the other hand, if weight of the nonwoven fabric for loop material is more than 150g/m^2, the air permeability is lowered and the cost is increased, and it difficult to use such a nonwoven fabric for loop material of hook-and-loop fastener for disposable goods.

It is preferred that air permeability of the nonwoven fabric for loop material of hook-and-loop fastener according to the invention is preferably not less than 80cc/sec・cm^2 and, more preferably, in the range of 80 to 250 cc/sec・cm^2. If a nonwoven fabric for loop material, whose air permeability is less than 80 cc/sec・cm^2, is used for disposable goods that directly touch the skin, the nonwoven fabric brings about stuffiness and inhibits sweat to evaporate, which results in any skin trouble.

Described hereinafter is a preferable manufacturing process of the nonwoven fabric for loop material of hook-and-loop fastener according to the invention. To manufacture the nonwoven fabric for loop material of hook-and-loop fastener, first a nonwoven fabric base and a filamentous web are prepared.

The nonwoven fabric base can be prepared through any conventionally known method. That is, a nonwoven fabric, in which heat-bonded portions are dispersed, is prepared by accumulating thermoplastic filaments A and partially

heat-bonding the thermoplastic filaments A, and this nonwoven fabric is used as the nonwoven fabric base. For example, if spunbond process is adopted, a nonwoven fabric base is obtained through the following process. First, while drawing the thermoplastic filaments A by melt spinning method, the thermoplastic filaments A are accumulated on a moving collecting conveyor, thus a filamentous nonwoven web is obtained. More specifically, a thermoplastic polymer is molten and spun out of a normal spinneret, the spun filaments are qrenched, drafted and attenuated by an air sucker, and opened by a publicly known method, and then the filaments are accumulated on a moving accumulating apparatus as a filamentous nonwoven web. In this process, it is preferred that the air sucker draws the filaments at a spinning speed in the range of, for example, about 3000 to 6000m/min. If the spinning speed is less than 3000m/min., molecular orientation of each thermoplastic filament A does not sufficiently grow, and therefore the obtained thermoplastic filaments A tend to have insufficient tensile strength. As a result, the obtained nonwoven fabric for loop material tends to easily stretch when it is peeled from the hook material and is deteriorated in dimensional stability. On the other hand, if the spinning speed is more than 6000m/min., each thermoplastic filament A tends to cut, and spinning efficiency at the time of melting and spinning the filaments is decreased.

The obtained filamentous nonwoven web is provided with partially heat-bonded portions which are dispersed, and thus a nonwoven fabric base is obtained. As for the method for providing the heat-bonded portions, there are following

several methods: a method of heat-bonding the filaments A together by passing the filamentous nonwoven web through between a pair of heated engraved rollers or between a heated engraved roller and a flat roller, thereby softening or melting the thermoplastic filaments A at the portions coming in contact with the non-engraved parts of the engraved roller; a method of heat-bonding the filaments A together by putting a plate partially provided with holes or a net on the filamentous nonwoven web, applying a hot air through the plate or net, and softening or melting the thermoplastic filaments A at the portions to which the hot air is applied; or a method of heat-bonding the filaments A together by passing the filamentous nonwoven web through an ultrasonic bonding apparatus comprising a pair of engraved rollers or an engraved roller and a flat roller and softening or melting the thermoplastic filaments A at the portions coming in contact with the non-engraved parts of the engraved roller.

Configuration of each heat-bonded portion dispersed in the nonwoven fabric base is decided depending on figure or size of end face of each non-engraved part of the engraved roller or density of the arranged non-engraved parts, or depending on figure or size of each hole in the plate the net through which hot air passes at the time of applying the hot air treatment. Therefore, as for the configuration of each non-engraved part or that of each hole in the plate or the net, as well as configuration of each heat-bonded portion in the nonwoven fabric base described above, it is preferred that size of the end face of each non-engraved part, size of each hole in the plate or the net is in the range of 0.04 to 2mm^2. Gross size rate of the end face of

each non-engraved part or gross size rate of each hole is preferably in the range of 2 to 50% of whole surface size of the engraved roller (including end faces of the non-engraved parts) or whole surface area of the plate or the net (including the holes).

In the case of using the heated engraved roller, the engraved roller is heated to a temperature lower than the melting point of the thermoplastic polymer composing the thermoplastic filaments A. It is preferred that the temperature is established to be in the range less than the melting point but not less than a temperature which is lower than the melting point by 60℃. In the case that each thermoplastic filament A is sheath-core type conjugate filament composed of a sheath component of a low melting point polymer and a core component of a high melting point polymer, the temperature is decided on the basis of the melting point of the low melting point polymer and is preferably established to be in the range from less than the melting point of the low melting point polymer to not less than a temperature which is lower than the melting point by 60℃. If the temperature of the heated engraved roller is not lower than the melting point, the softened or molten polymer sticks to the non-engraved parts coming in contact with the thermoplastic filaments A, which brings about decrease in productivity. If the temperature is less than a temperature which is lower than the melting point by 60℃, the thermoplastic filaments A are not sufficiently heat-bonded depending on linear pressure between the rollers, thus the obtained nonwoven fabric base may be insufficient in mechanical strength. The linear pressure between the rollers

can be freely selected depending on the weight of the filamentous nonwoven web to be processed, but is preferably in the range of 98 to 980N/cm. The processing speed depends on the heating temperature and the linear pressure between the rollers, but is preferably in the range of 5 to 50m/min.

In the case of applying a hot air, the processing temperature is established to be not lower than the melting point of the thermoplastic polymer composing the thermoplastic filaments A, and the temperature is preferably in the range from the melting point to a temperature which is higher than the melting point by 20℃. In the case that each thermoplastic filament A is sheath-core type conjugate filament composed of a sheath component of a low melting point polymer and a core component of a high melting point polymer, the temperature is decided on the basis of the melting point of the low melting point polymer.

In this manner, the nonwoven fabric base is obtained. On the other hand, the filamentous web is easily prepared just by accumulating the thermoplastic filaments B. For example, the filamentous nonwoven web formed at the time of obtaining the nonwoven fabric base can be used as the filamentous web without any further treatment. In other words, if the thermoplastic filaments B are used instead of the thermoplastic filaments A at the time of obtaining the nonwoven fabric base, the obtained filamentous nonwoven web itself can be used as the filamentous web as it is. If the same filaments are used as the thermoplastic filaments A and the thermoplastic filaments B, the filamentous nonwoven web manufactured at the time of obtaining the nonwoven fabric base can be used as the filamentous web without any further

treatment. There is a difference between the filamentous web and the nonwoven fabric base in the aspect that the former does not have any heat-bonded portion where the filaments are heat-bonded together, while the latter has such heat-bonded portions.

Next, the prepared nonwoven fabric base and the filamentous web are laminated and needle-punched from the filamentous web side. Thus, the thermoplastic filaments B in the filamentous web pass through the nonwoven fabric base and form loops on the surface of the nonwoven fabric base. Further, the thermoplastic filaments B are entangled with the thermoplastic filaments A existing among the heat-bonded portions in the nonwoven fabric base, whereby the nonwoven fabric base and the filamentous web are joined together more tightly. A following theory is applied to this process. The thermoplastic filaments B in the filamentous web are merely accumulated, and not fixed. Accordingly, in a laminate formed by laminating the filamentous web and the nonwoven fabric base, needle punching is applied from the filamentous web side, whereby punching needles catch the thermoplastic filaments B eaisting freely in the filamentous web. The thermoplastic filaments B caught by the punching needles pass through among the heat-bonded portions in the nonwoven fabric base and form loops on the surface of the nonwoven fabric base. At this time, the thermoplastic filaments A of the nonwoven fabric base are not easily caught by the punching needles because the thermoplastic filaments A are secured by the heat-bonded portions, and the thermoplastic filaments A do not substantially form loops. Further, the thermoplastic filaments A existing among the heat-bonded

portions in the nonwoven fabric base are secured by the heat-bonded portions, but in the areas other than the heat-bonded portions the thermoplastic filaments A can move freely to a certain extent. Therefore, the thermoplastic filaments A are entangled with the thermoplastic filaments B by the needle punching, and the nonwoven fabric base and the filamentous web are joined together more tightly.

Punching density of the needle punching is selected freely depending on the kind of the punching needles to be used and the needle depth in punching, but is preferably in the range of 20 to 100 times/cm^2 in general. If the punching density is less than 20 times/cm^2, the loops formed on the nonwoven fabric base are insufficient in number. Moreover, the thermoplastic filaments A are not sufficiently entangled with the thermoplastic filaments B, and the nonwoven fabric base and the filamentous web are joined together less tightly. On the other hand, if the punching density is more than 100 times/cm^2, the punching needles seriously damage the thermoplastic filaments A and B, and the strength of the filaments themselves tends to be decreased. As a result, mechanical strength of the obtained nonwoven fabric for loop material of hook-and-loop fastener tends to be insufficient.

By applying the foregoing needle punching, it is possible to obtain a nonwoven fabric for loop material of hook-and-loop fastener according to the invention. However, it is more preferred to provide a thermally-press-joined areas and areas not thermally-press-joined by the following method in order to prevent the loops from getting out. The needle-punched nonwoven fabric for loop material (a precursor in this case) is cause to pass through between

a heated engraved roller and a flat roller so that the loop side comes in contact with the engraved roller. Alternatively, the nonwoven fabric for loop material (the precursor) is caused to pass through between a pair of engraved rollers in which at least one of the engraved rollers is heated and non-engraved parts of respective engraved rollers come in contact with each other. In this manner, the areas in contact with the non-engraved parts are turned into a thermally-press-joined areas, and the areas corresponding to engraved parts are turned into areas not thermally-press-joined.

In this process, at the time of using the heated engraved roller and the flat roller, it is preferred to consider the heating temperature applied to the flat roller. In other words, it is preferred to consider the temperature for heating the flat roller in order to prevent the thermoplastic filaments B from being softened or molten by the heat in the filamentous web of which full side is put in contact with the flat roller. For example, in the case that the thermoplastic filaments B are polyethylene terephthalate (of which melting point is about 255℃), it is preferred to heat the flat roller to about 160 to 180℃, and in the case that the thermoplastic filaments B are polyethylene (of which melting point is about 130℃), it is preferred to heat the flat roller to about 90℃. As for the engraved roller coming in contact with the loop side, in the case that the thermoplastic filaments A and B are polyethylene terephthalate (of which melting point is about 255℃), it is preferred to heat the engraved roller to about 230 to 240℃, and in the case that the thermoplastic filaments A

and B are polyethylene (of which melting point is about 130℃), it is preferred to heat the engraved roller to about 120℃. The heating temperature of the flat roller coming in contact with the filamentous web is established to be low. This is because of preventing the thermoplastic filaments B in the filamentous web from being heat-bonded by softening or melting due to the heat in the areas not thermally-press-joined and keeping the softness and air permeability of the nonwoven fabric for loop material of hook-and-loop fastener. If the temperature of the flat roller is higher than the mentioned temperature, the thermoplastic filaments B tend to be easily molten and bonded, and the obtained nonwoven fabric for loop material is stiff and hard to the touch and low in air permeability.

It is preferred that height (engraving depth) of the non-engraved parts of the engraved roller is not less than 1mm and, more preferably, not less than 2mm. If the non-engraved parts are less in height, the engraved parts of the engraved roller are easy to come in contact with the loops. Consequently, the loops tend to be molten and stuck or broken due to the heat of the engraved roller, and joining performance with the hook material is decreased. Maximum height of the non-engraved parts is not specifically limited, but is preferably about 3mm considering abrasion of the engraved roller and engraving cost.

Any configuration can be adopted for the non-engraved parts of the engraved roller. The configuration of the thermally-press-joined areas and the areas not thermally-press-joined may be decided depending on the configuration of the non-engraved parts and so on. In this

invention, it is preferred that each area not thermally-press-joined is surrounded by the thermally-press-joined area. Therefore, it is preferred to adopt an engraved roller having continuous non-engraved part and engraved part surrounded by the non-engraved part to serve as the engraved roller. Further, it is preferred that the engraved roller has plural engraved parts. The size of each engraved part is preferably not smaller than $5mm^2$, and the gross size of the engraved parts is preferably in the range of 40 to 90% of the whole surface size of the engraved roller (including the non-engraved parts).

It is also preferred to adopt a process of applying a binder resin in the final step for the purpose of improving the dimensional stability of the obtained nonwoven fabric for loop material or preventing the loops from getting out. For example, by dipping the nonwoven fabric for loop material in a binder resin solution or by spraying the binder resin solution on the nonwoven fabric for loop material, then drying the nonwoven fabric, it is possible to obtain a nonwoven fabric for loop material to which the binder resin is entirely applied.

An example of the manufacturing process of the nonwoven fabric for loop material of hook-and-loop fastener according to the invention is illustrated in Fig. 8. A filamentous web 3 is laminated on a nonwoven fabric base 1, and punching needles 7 are caused to pass through the laminate from the filamentous web 3 side to the nonwoven fabric base 1 side by means of a needle punching machine provided with the punching needles 7. In this manner, the loops are formed on the surface of the nonwoven fabric base 1. Thereafter,

the laminate is caused to pass through between the heated engraved roller 8 and the flat roller 9. As a result, it is possible to obtain a nonwoven fabric for loop material of hook-and-loop fastener in which the portions corresponding to the non-engraved parts of the engraved roller are turned into the thermally-press-joined areas and the portions corresponding to the engraved parts are turned into the areas not thermally-press-joined.

Further Modes for Carrying Out the Invention

An object of the present invention is to provide a nonwoven fabric for loop material of hook-and-loop fastener having dimensional stability and joining strength necessary for use in disposable goods and capable of being used not only as a loop material but also as a fabric. However, it is to be noted that the foregoing object can be accomplished, without using any nonwoven fabric base, by establishing a specific relation between the thermally-press-bonded area and the areas not thermally-press-bonded. That is, by providing plural areas not thermally-press-bonded and thermally-press-bonded area that surrounds each individual area not thermally-press-bonded and are continuous as a whole, it is possible to obtain the nonwoven fabric for loop material of hook-and-loop fastener having desired dimensional stability and peeling strength without any nonwoven fabric base.

Such a nonwoven fabric for loop material is composed of the thermoplastic filaments B, and the thermoplastic filaments B are entangled with each other. The nonwoven fabric for loop material has the plural areas not

thermally-press-bonded, where the thermoplastic filaments B are not heat-bonded together, and the continuous thermally-press-bonded area, where the thermoplastic filaments B are heat-bonded together, surrounding each of the areas not thermally-press-bonded. Surface of the reas not thermally-press-bonded serves as the loop side having loops composed of the thermoplastic filaments B, and the thermoplastic filaments B are not substantially fixed to each other on the non-loop side opposite to the loop side.

This nonwoven fabric for loop material is a nonwoven fabric excluding the nonwoven fabric base from the mentioned nonwoven fabric for loop material. Moreover, the thermally-press-bonded area is arranged to have a continuous configuration surrounding the areas not thermally-press-bonded. In the concrete, it is preferred to adopt the thermally-press-bonded area as shown in Fig. 4 or Fig. 5. Other particulars are the same as those in the foregoing nonwoven fabric for loop material of hook-and-loop fastener. Fig. 9 shows an example of this nonwoven fabric for loop material, and in which numeral 5 is the thermally-press-bonded area, and numeral 6 is the area not thermally-press-bonded. The loops 4 are formed on the surface of the area 6 not thermally-press-bonded, and the surface serves as the loop side.

The manufacturing process of this nonwoven fabric for loop material is a process for excluding the nonwoven fabric base from the foregoing nonwoven fabric for loop material where the nonwoven fabric base is used. Furthermore, an engraved roller having plural engraved parts and a continuous non-engraved part surrounding the engraved parts is used

as the heated engraved roller. Other particulars are the same as those in the foregoing manufacturing process of the nonwoven fabric for loop material. However, since any nonwoven fabric base is not used, it is preferred that weight of the filamentous web is not less than $20g/m^2$ and, more preferably, in the range of 20 to 150 g/m^2.

Brief Description of Drawings

Fig. 1 is a plan view showing an example of the nonwoven fabric base used in the invention.

Fig. 2 is a schematic side view showing an example of the nonwoven fabric for loop material of hook-and-loop fastener according to the invention.

Fig. 3 is a schematic side view showing another example of the nonwoven fabric for loop material of hook-and-loop fastener according to the invention.

Fig. 4 is a plan view showing an example of the configuration of the thermally-press-joined area employed in the invention.

Fig. 5 is a plan view showing another example of the configuration of the thermally-press-joined area adopted in the invention.

Fig. 6 is a plan view showing a further example of the configuration of the thermally-press-joined areas adopted in the invention.

Fig. 7 is a plan view showing a yet further example of the configuration of the thermally-press-joined areas adopted in the invention.

Fig. 8 is a schematic side view showing an example of a manufacturing process of the nonwoven fabric for loop

material of hook-and-loop fastener according to the invention.

Fig. 9 is a schematic side view showing an example of the nonwoven fabric for loop material of hook-and-loop fastener according to the invention.

Embodiment A

Example 1

[Preparation of Filamentous Web]

Polyethylene terephthalate whose melting point is 255℃ was molten at 285℃ and spun out of a spinneret. An air sucker drew the polyethylene terephthalate at a spinning speed of 5000m/min. The drawn polyethylene terephthalate filaments B were accumulated on a collecting conveyor, and a filamentous web of 35g/m^2 in weight was obtained. Each of the polyethylene terephthalate filaments B was 3.3 dtex in fineness.

[Preparation of Nonwoven Fabric Base]

The foregoing filamentous web was caused to pass through between an engraved roller heated to 230℃ and a flat roller of normal temperature, thus a nonwoven fabric base was obtained. In the nonwoven fabric base, heat-bonded portions were dispersed, and each individual heat-bonded portion was 0.4mm^2 in size. The gross size of the heat-bonded portions was 10% of the surface size of the nonwoven fabric base, and the nonwoven fabric base was 250μm in thickness. The polyethylene terephthalate filaments A forming the nonwoven fabric base are the same material as the polyethylene terephthalate filaments B. The nonwoven fabric base was 35g/m^2 in weight and 250μm in thickness.

[Preparation of Nonwoven Fabric for Loop Material of Hook-and-Loop Fastener]

The filamentous web and the nonwoven fabric base were laminated and needle-punched by a needle-punching machine (needles: crown barb needles produced by Foster,). The needle punching was performed under the conditions that the punching needles were caused to pass through the laminate from the filamentous web side. Punching density was 50 times/cm^2, and needle depth in punching was 9mm. The needle-punched laminate was caused to pass through between an engraved roller heated to 230℃ and a flat roller heated to 200℃. The non-engraved part of the engraved roller is honeycomb-shaped as shown in Fig. 4 so that the honeycomb-shaped thermally-press-joined area may be formed, and the non-engraved part was 1.5mm in height. Size of each individual area not thermally-press-joined surrounded by the thermally-press-joined area was 100mm^2, and the gross size occupied by the areas not thermally-press-joined was 76% of the whole surface size. Then, the laminate was dipped in acrylic resin emulsion (produced by Dainippon Ink & Chemicals, Inc.) so that the deposit amount of solid acrylic resin may be 6% by weight, and then dried. Thus, a nonwoven fabric for loop material of hook-and-loop fastener was obtained.

Example 2

[Preparation of Filamentous Web]

Polyethylene terephthalate whose melting point is 255℃ was used as a core component, and high density polyethylene whose melting point is 125℃ was used as a sheath

component. They were molten and spun out of a conjugate spinneret, and were drawn by an air sucker. The drawn sheath-core type conjugate filaments B (conjugate ratio of the core and the sheath was 1/1 in ratio by mass) were accumulated on a collecting conveyor, thus a filamentous web of 30g/m^2 in weight was obtained. Each of the sheath-core type conjugate filaments B was 4.4 dtex in fineness.

[Preparation of Nonwoven Fabric Base]

A filamentous web was obtained by the method used in Example 2 except for using sheath-core type conjugate filaments of 3.5 dtex in fineness. Using this filamentous web, a nonwoven fabric base was prepared through the method used in Example 1 except for heating the engraved roller to 120℃. This nonwoven fabric base was 30g/m^2 in weight and 200μm in thickness.

[Preparation of Nonwoven Fabric for Loop Material of Hook-and-Loop Fastener]

The filamentous web and the nonwoven fabric base were laminated and needle-punched by the method used in Example 1. The needle-punched laminate was caused to pass through between an engraved roller heated to 120℃ and a flat roller heated to 90℃, and a nonwoven fabric for loop material of hook-and-loop fastener was obtained without applying binder resin. The non-engraved part of the engraved roller was lattice-shaped as shown in Fig. 5 so that the lattice-shaped thermally-press-joined area may be formed, and the non-engraved parts were 1.5mm in height. Size of each individual area not thermally-press-joined surrounded by the thermally-press-joined area was 25mm^2, and the gross size occupied by the areas not thermally-press-joined was 59%

of the whole surface size.

Example 3

A nonwoven fabric for loop material of hook-and-loop fastener was obtained by the method used in Example 2, with the exception that the non-engraved parts of the engraved roller used in Example 2 was changed to a large lattice-shaped configuration, each individual area not thermally-press-joined surrounded by the thermally-press-joined area was 100mm^2 in size, and the gross size occupied by the areas not thermally-press-joined was 76% of the whole surface size.

Example 4

A nonwoven fabric for loop material of hook-and-loop fastener was obtained by the method used in Example 2, with the exception that the non-engraved parts of the engraved roller used in Example 2 were changed to a texture-shaped configuration as shown in Fig. 6 and the gross size occupied by the area not thermally-press-joined was 71% of the whole surface size.

Example 5

A nonwoven fabric for loop material of hook-and-loop fastener was obtained by the method used in Example 3, with the exception that the nonwoven fabric base used in Example 3 was changed to a nonwoven fabric base of 55g/m^2 in weight and 450μm in thickness.

Example 6

A nonwoven fabric for loop material of hook-and-loop fastener was obtained by the method used in Example 2, with the exception that the non-engraved part of the engraved roller used in Example 2 was changed to a more tight

lattice-shaped configuration, each individual area not thermally-press-joined surrounded by the thermally-press-joined area was $4mm^2$, and the gross size occupied by the areas not thermally-press-joined was 44% of the whole surface size.

Example 7

After the needle punching process in Example 2, a nonwoven fabric for loop material of hook-and-loop fastener was obtained without any further process.

Example 8

A nonwoven fabric for loop material of hook-and-loop fastener was obtained by the method used in Example 3, with the exception that height of the non-engraved part of the engraved roller used in Example 3 was changed to 2.5mm.

Characteristics of the nonwoven fabrics for loop material of hook-and-loop fastener obtained in the foregoing Examples 1 to 8 in Embodiment A are as shown in Table 1.

Table 1

		Example							
		1	2	3	4	5	6	7	8
Softness cN		127	83	64	49	196	245	49	59
Peeling Strength N/cm		0.64	0.39	0.29	0.49	0.20	0.10	0.29	0.39
Fluffing after Peeling		5	5	4	3	3	4	2	4
Air Permeability cc/sec・cm^2		155	130	160	93	115	82	190	125
Strength at 5% Extension N	MD	56.4	49.8	38.6	47.4	61.3	15.1	32.6	55.3
	CD	37.6	34.8	24.1	30.2	42.6	39.3	22.2	32.5

The characteristics shown in Table 1 were respectively measured in the following methods.

(1) Softness (cN)

A rectangular test piece of 5cm in MD direction (mechanical direction) and 10cm in CD direction (direction crossing the mechanical direction at right angles) was cut out of the nonwoven fabric for loop material of hook-and-loop fastener. Short sides of the test piece were put together and middle part thereof was pasted together with tape, thereby a cylindrical test piece was prepared. The test piece was stood on a flat board and crushed with another flat board perpendicular to an MD direction. Maximum strength applied

to the flat board at that moment was measured with a Tensilon RTM-500 produced by Toyo Baldwin at a compression speed of 50mm/min and adopted as the compression bending strength in MD direction.

Then, the direction of the cutout test piece was changed, and the compression bending strength in CD direction was obtained in the same manner. The values of the compression bending strength were measured with n = 5 in MD and CD directions respectively, and the average of all the measured values was employed as the compression bending strength and used as an index of softness. The more this value is smaller, the more the nonwoven fabric is superior in softness. The softness is preferably not more than 196cN and, more preferably, not more than 147cN.

(2) Strength at 5% Extension (N)

A rectangular test piece of 5cm in CD direction and 30cm in MD direction was cut out of the nonwoven fabric for loop material of hook-and-loop fastener . The above-mentioned Tensilon was used to measure the strength at the time of extending the test piece by 5% in MD direction under the conditions that the distance between chucks was 20cm and the extension speed was 20cm/min. The obtained result was employed as the average value of n = 5, and this value was used as the strength at 5% extension (in MD direction). Further, a rectangular test piece of 5cm in MD direction and 30cm in CD direction was cut out, and the strength at 5% extension (in CD direction) was obtained in the same manner. Note that the nonwoven fabric for loop material of hook-and-loop fastener extends about 5% in many cases when it is actually used, and therefore it is considered

that the strength at 5% extension shows the degree of the dimensional stability under such situation.

(3) Peeling Strength (N/cm)

Measurement was carried out in accordance with the test method of hook-and-loop fastener specified in JIS L3416. A test piece of 25mm in width and 100mm in length was cut out of the nonwoven fabric for loop material of hook-and-loop fastener and placed on a Mushroom tape (hook side) of the same size produced by YKK (company name). Then, the test piece and the Mushroom tape were pressed by applying an iron roller of 24.5N twice onto them in reciprocating direction so that they may be joined together at their end portions by 50mm in length. The test piece was peeled from the Mushroom tape using the foregoing Tensilon under the conditions that the distance between chucks was 10cm and the extension speed was 30cm/min. The strength value was obtained by averaging six maximum values and six minimum values indicated at the time of peeling the test piece from the Mushroom tape, and the average of n = 5 was employed as the peeling strength.

(4) Fluffing after Measuring Peeling Strength

After measuring the peeling strength of the test piece, the hook material surface (the loop side) of the test piece was observed visually, and the state of fluff raised by cutting out or getting out of the loops was evaluated on the following five grades.

5; excellent

4; good

3; average

2; below average

1; unsatisfactory

(5) Air Permeability (cc/sec・cm^2)

Measurement was carried out in accordance with the test method specified in JIS L1096.

Embodiment B

Example 10

Polyethylene terephthalate whose melting point is 255℃ was molten at 285℃ and spun out of a spinneret. An air sucker drew the polyethylene terephthalate at a spinning speed of 5000m/min. The drawn polyethylene terephthalate filaments B were accumulated on a collecting conveyor, and a filamentous web of $80g/m^2$ in weight was obtained. Each of the polyethylene terephthalate filaments B was 7 dtex in fineness.

The obtained filamentous web was needle-punched by a needle-punching machine (needles: Crown barb needles produced by Foster). The needle punching was performed under the conditions that the punching needles were caused to pass through the filamentous web, the punching density was 50 times/cm^2, and the needle depth in punching was 9mm. As a result, the filamentous web was provided with a large number of loops on the opposite side of the side from which the punching needles pass through, and the polyethylene terephthalate filaments B were entangled with each other.

The needle-punched filamentous web was caused to pass through between an engraved roller heated to 235℃ and a flat roller heated to 190℃. The non-engraved part of the engraved roller was honeycomb-shaped as shown in Fig. 4 so that the honeycomb-shaped thermally-press-bonded area may be formed. The non-engraved part was 2.5mm in height. Size of each

individual area not thermally-press-bonded surrounded by the thermally-press-bonded area was 85mm², and the gross size occupied by the areas not thermally-press-bonded was 60% of the whole surface size. Next, the filamentous web was dipped in acrylic resin emulsion (produced by Dainippon Ink & Chemicals, inc.) so that the deposit amount of solid acrylic resin may be 6% by weight, and then dried. Thus, a nonwoven fabric for loop material of hook-and-loop fastener was obtained.

Example 11

Polyethylene terephthalate whose melting point is 255 ℃ was used as a core component and high density polyethylene whose melting point is 125℃ was used as a sheath component. They were molten and spun out of a conjugate spinneret, then were drawn by an air sucker. The drawn sheath-core type conjugate filaments B (conjugate ratio of the core and the sheath was 1/1 in ratio by mass) were accumulated on a collecting conveyor, and a filamentous web of 75g/m² in weight was obtained. Each of the sheath-core type conjugate filaments B was 7 dtex in fineness.

The obtained filamentous web was needle-punched under the same conditions as in Example 10.

The needle-punched filamentous web was caused to pass through between an engraved roller heated to 125℃ and a flat roller heated to 120℃. The non-engraved part of the engraved roller was lattice-shaped as shown in Fig. 5 so that the lattice-shaped thermally-press-bonded area may be formed. The non-engraved part was 3mm in height. Size of each individual area not thermally-press-bonded surrounded by the thermally-press-bonded area was 25mm², and the gross size

occupied by the areas not thermally-press-bonded was 59% of the whole surface size. Thus, a nonwoven fabric for loop material of hook-and-loop fastener was obtained. Note that, in this example, any binder resin was not applied to the filamentous web.

Example 12

A nonwoven fabric for loop material of hook-and-loop fastener was obtained by the method used in Example 11, with the exception that the filamentous web was 75g/m^2 in weight, the non-engraved part of the engraved roller to be used was largely lattice-shaped, and the temperature of the engraved roller was 95℃. As a result of using the engraved roller having the large lattice-shaped non-engraved part, size of each individual area not thermally-press-bonded was 100mm^2, and the gross size occupied by the areas not thermally-press-bonded was 62% of the whole surface size.

Characteristics of the nonwoven fabrics for loop material of hook-and-loop fastener obtained in Examples 10 to 12 in Embodiment B described above are as shown in Table 2.

Table 2

		Example		
		10	11	12
Softness	(cN)	142	123	74
Peeling Strength	(N/cm)	0.74	0.55	0.63
Fluffing after Peeling		5	5	4
Air Permeability (cc/sec・cm^2)		129	125	143
Strength at 5% Extension (N)	CD	36.9	32.8	22.3

The softness, peeling strength, fluffing after peeling, and air permeability were measured in the same method as in Embodiment A.